The Age of Knowledge

Looking back over history, one can identify certain
abrupt changes, discontinuities, in the nature,
the very fabric of our civilization...

The Renaissance, the Age
of Discovery, the Industrial Revolution

There are many who contend that our society is
once again undergoing such a dramatic shift in
fundamental perspective and structure.

As Erich Bloch, Director of the National Science Foundation
suggests, we are entering a new age, an "Age of
Knowledge"

The signs are all about us.

Today we are evolving rapidly to a new post-industrial,
knowledge-based society, just as a century ago our
agrarian society evolved through the Industrial Revolution.

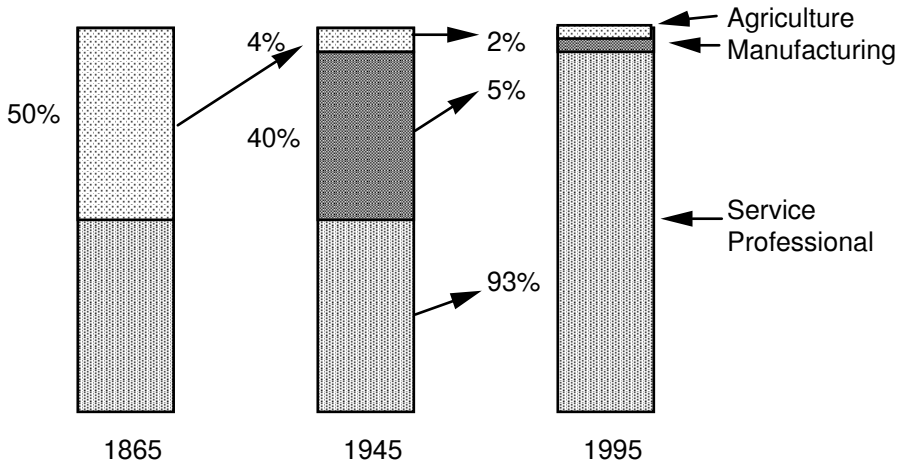
Key element in transformation, is the emergence of knowledge
as the new critical commodity, as important as mineral ores,
timber, and access to low skilled labor were at an earlier time.

This new critical commodity knows no boundaries.
It is generated and shared wherever educated, dedicated,
and creative people come together...and, as we have learned,
it spreads very quickly.

Knowledge and the people who can create and use it are the
new strategic resource.

Some examples:

1. Industrial production is steadily switching away from
material and labor intensive products and processes
to knowledge intensive processes:
In a car, 40% materials, 25% labor...
In a chip, 1% materials, 10% labor, 70% knowledge!!!
(In fact, the material for computer chips is the
world's most common substance...sand!!!)
High-tech industries based on knowledge--computers,
semiconductors, biotechnology, synthetic materials,
are replacing industries based on natural resoures as
the source of economic growth and strategic strength.
2. Our nation's future has probably never been less constrained
by the cost of natural resources. Future areas of
growth are likely to come from the application of technologies
that require few natural resources.
3. Increasing manufacturing production has come to mean
decreasing blue collar employment!
In the 1920s, 1 of 3 was a blue-collar worker
today 1 in 6 and dropping fast
probably to about 1 in 20 within a couple of decades...
Indeed, UM economic studies suggest that less than 5%
of General Motors' work force will be unskilled labor
by the year 2000.
Noland-Norton



4. Recent Office of Technology Assessment report:
   40% of all new investment in plant and equipment goes to purchase information technology
5. What's more, these new technologies magnify the effects of change. "Today the velocity of change is so great... that the tectonic plates of national sovereignty and power have begun to shirt" (Walter Wriston)
   We are in the midst of an information revoution that is changing the basis of economic competitiveness and world power.
   Indeed, if you want to know the real reason why the we are now seeing the extraordinary transformations in the Soviet Union and Eastern Europe, it is not due to diplomacy or economics but rather the silicon chip... that is, to modern communication and information technology which make it impossible for totalitarian governments to isolate their societies from the rest of the world.
   Today information and data flow quickly around the world. We learn about events almost as they occur. The world is linked electronically. And, as a result, the relationships between nations and the pace of change are increasing rapidly.
   For example, pictures taken by the french commercial satellite and quickly published world-wide forced Soviet officials to disclose the full seriousness of the Chernobyl disaster.
   A global economy is not only possible; it exists. Markets are changing and realigning. We have seen it in the far east and now we are seeing it in Europe.
6. Today a microprocess can caluclate the orbit of Mars in about 4 seconds, a taks that took Johannes Kepler 4 years.
   A researcher can have on a desktop more computing power than existed in a standard mainframe only 10 years ago.
   Modern electronic technologies have increased vastly out capacity to know and do things. Moverover, they allow\ us to transmit information quickly and widely, linking distant places and diverse areas of endeavor in productive new ways.

These technologies make many things possible.
   But they don't make things happen.
   Only people make things happen.

US and Japan already have become postindustrial societies; with predominate sectors in service and high tech. By 1990, 75% of US labor force in services---not burger flipping, but financial services, professional and design services,

and human services. Core of postindustrial society is professional and technical services.

A fundamental transformation is underway in our economy that is reshaping virtually every product, every service, and every job in the United States.

In our country, as in all developed nations, "knowledge workers" have already become the center of gravity of the labor force.

A transition in which..

Intellectual capital--brainpower-- is replacing financial and physical capital as key to our strength, prosperity, and well-being

This is having a profound impact on our social

structure, culture, and economy.

In this age of knowledge, one of our greatest strengths is

our system of higher education.

Our colleges perform over half of the basic research in America.

They produce essentially all of our knowledge workers.

By coupling research and education, our academic institutions provide an unmatched opportunity for advanced training and learning-by-doing.

The fact that our schools draw students and faculty from all over the globe and attract investment from foreign companies indicates that in a competitive educational market, our institutions are delivering the best product. They are probably more competitive today in the world marketplace than any other US "industry".

The Role of Technology

And in this age, the major force behind economic change is technology, itself.

Of course, we know that technology has played an increasingly important role for many years.

Technological innovation, achieved by applying new knowledge created through basic research, has been responsible for nearly half of all US productivity gains since WWII

At another level, technologies of transportation and communication make possible an integrated economy.

Tremendous new industries have been created by new technical knowledge: electronics is the obvious example of the last three decades; biotechnology may be the example for the coming three decades.

These industries depend on knowledge as the most critical resource.

But knowledge is highly mobile...it is not tied to geographic regions as coal or iron or oil.

Earlier historical periods that we remember with catch-phrases.. the "Age of Reason", the "Age of Revolution", the "Age of Discovery", were limited geographically to Europe. So was the Industrial Revolution since technology did not allow rapid dissemination of knowledge.

By contrast, the knowledge revolution is happening worldwide and at a very rapid rate.

That new technology means economic development and trade is widely understood in developed nations who have been sharply increasing their investments in science and technology.

But less developed nations are also learning the lesson and drawing knowledge from the developed world or generating it themselves.

Brazil, India, Korea are quickly advancing along the competitive path that Japan took 30 years before.

Example:

Over past two decades, India has increased its population

of scientists and engineers by tenfold!!!

Note: As more countries understand that knowledge is now the critical resource, more are undertaking serious research programs. Our nation is already being challenged in the knowledge business itself.

The handwriting is on the wall...

Our economy is at a crossroads...and its future course rests on a disparate set of conscious choices.

Whether the economy moves on a path leading to stagnation, rising imports, and growing unemployment

or on a path of rapid growth and technological change, will require "an unflinching reexamination of the way businesses are managed"

Maintaining America's competitive edge requires attention to our traditional strength -- people and research -- and a strong offensive strategy based on these resources.

Taxes, trade, and fiscal policies influence economic competitiveness. But in the long run, a strong base of science and engineering research and education is more important.

Central theme is that education, broadly defined, will play a pivotal role in the coming economic transition and its impact on individuals.

Previous economic transformations were closely assocaited with major public investment in infrastructure such as railroads, canals, electric networks, and highways. In the coming economic transition, an equivalent infrastructure will be an educated population.

Synergisms

While some warn against expecting more from science in the coming years, HTS disagrees. The critical new dimension of the next decades will be the newe synergetic and productive relationship among science, technological innovation, and the implementation of new technology. This will coincide with the increasing internationalziation of world markets.

Most new technologies have international rather than national origins and will depend on the international transfer of technology for thei full development.

A particular challenge:

Even as our society becomes more knowledge dependent, we are confronted with a shrinking college-age population and declining degree attainment at all levels of higher education.

What has come to be called the "pipeline" problem pervades the entire educational system. It is reflected in the absence of science and math courses and prepared faculty in K-12, in the low standing of our students in international comparisons, and in the pervasive disinterest and lack of preparation of our students in college-level careers in science and engineering.